

study. The sites in the extensive study also showed a pattern of net nutrient removals in the downstream swamp-stream systems, although the data base was small. Ammonium removal was generally poor and inconsistent at the extensive sites, especially where effluent concentrations were relatively low.

The efficiencies of nutrient removal at the intensive sites were generally similar to removals which have been measured in other N.C. Coastal Plain swamp streams. Furthermore, there was general agreement with results from other Southeastern states that riparian wetlands effectively trap sediments and nutrients from agricultural and municipal sources, delaying and reducing their transport to the coast.

General Recommendations

Maintaining good water quality in North Carolina estuaries is an important goal because of their economic, recreational, and aesthetic values. The forested bottomlands and swamps along Coastal Plain streams are multipurpose natural areas. Because of demonstrated capabilities of riparian forested wetlands to reduce nutrient loadings to the estuaries, it is critical that both the areal extent and the functional properties of the riparian wetlands be maintained. These wetlands must be protected from channelization and conversion to farmland, processes which destroy them, from adverse changes to vegetative structure and soil properties, and from hydraulic or nutrient overloading. The methods from this study provide relatively inexpensive methods for assessing wetland nutrient-removal abilities so that year-to-year changes in removal efficiency of many streams can be determined.

Additional research is needed regarding the relationships between nutrient loading and wetland functioning. One such study is the determination of the amount of change and potential damage to wetlands by municipal wastewater loads, for example changes to soil fauna, microbial populations, and plant associations close below the outfall. Knowledge of the rate of accumulation of phosphorus and other elements in the soils and biota below the outfall is also needed. We need to know the impacts of land use in the watershed, for example, the effect of suspended sediments from soil erosion on the efficiency of phosphorus removal from wastewater. Finally, incorporation of the results into models of nutrient flux from the watershed to the estuaries will help predict maximum permissible wastewater discharges without damaging swamp functioning. Studies such as these will ultimately aid in making management decisions regarding the importance of wetlands to water quality.